10031 (Pages : 2) Name.....

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THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2010

CE 09 303/PTCE 09 302—MECHANICS OF SOLIDS

(2009 admissions)

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

I. (a) List out the different types of stresses and strains.

(b) What is s bulk modulus ?

(c) Define the term simply supported beam.

(d) Write the Relationship between (i) bending stresses and raidus of curvature ; (ii) bending moment and radius of curvature.

(e) Define hoop stress.

(5 × 2 = 10 marks)

Part B

Answer any four *questions.*

II. (a) Derive an expression for the total extension of a uniformly tapering rod of diameters D_1 and D_2 when the rod is subjected to an axial load P.

(b) Draw SFD and BMD for a cantilever beam carrying a point load at the free end.

(c) What is meant by beam of uniform strength ? Explain.

(d) Derive the differential equation for deflection curve.

(e) Derive the Euler's formula for a column with one end hinged and other end is fixed.

(f) Derive the expression of Longitudinal stress for thin cyclindrical shell.

(4 × 5 = 20 marks)

Part C

III. (a) A member ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in figure 1. Calculate the force P_3 necessary for equilibrium if P_1 = 120 kN, P_2 = 220 kN and P_4 = 160 kN. Determine also the net change in the length of the member. Take E = 200 GN/m^2.

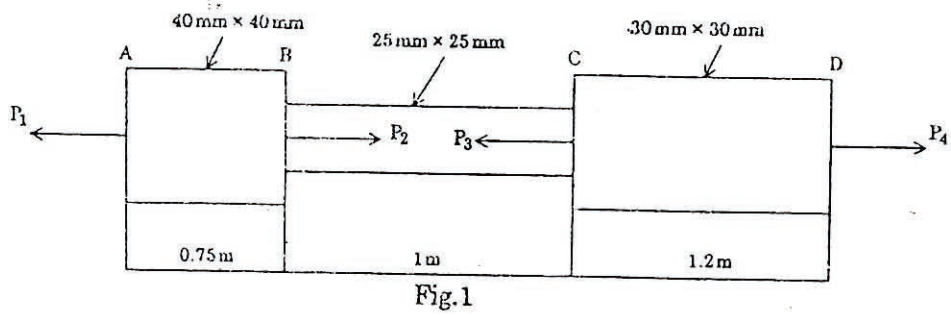

Fig.1

Or

Turn over

(b) A steel rod of diameter is enclosed centrally in a hollow copper tube of external diameter 4 cm and internal diameter of 3.5 cm. The composite bar is then subjected to an axial pull of 50,000 N. If the length of each bar is equal to 20 cm. determine (i) The stress in the rod and tube and (ii) load carried by each bar.

IV. (a) Draw SFD and BMD for the beam shown in figure 2. Indicate the position and the magnitude of maximum bending moment.

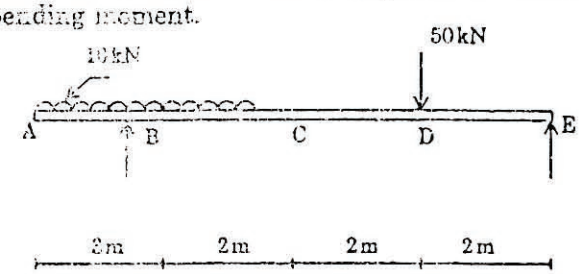

Fig.2

Or

(b) Draw SFD and BMD for the beam shown in figure 3. Indicate the position and the magnitude of maximum bending moment.

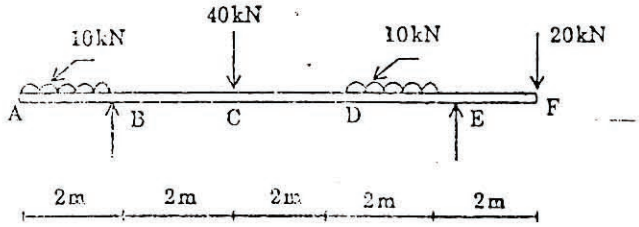

Fig.3

V. (a) A circular steel pipe of external diameter 60 mm and thickness 8 mm. is used as a simply supported beam over an effective span of 2 m. If permissible stress in steel is 150 N/mm^2 determine the maximum concentrated load that can be carried by it at mid span.

Or

(b) A symmetric I-section of size 180 mm × 400 mm. 8 mm thick is strengthened with 240 mm × 10 mm rectangular plate on top flange. If permissible stress in the material is 150 N/mm^2, determine how much concentrated load the beam of this section can carry at centre of 4 m span. Given ends of beam are simply supported.

VI. (a) A vertical steam boiler with 2 m. internal diameter and 4 m high is constructed with 2 cm thick plates for a working pressure of 10 kg./cm^2 The end plates are flat. Calculate :

(i) The stress in the circumferential plates due to pressure on the end plates.

(ii) Stress in the circumferential plates due to resisting the bursting effect.

(iii) Increase in length, diameter and the volume

Take Poisson's ratio = 0.3 and E = 2 × 10^6 kg./cm^2

Or

(b) A 1.5 mm long column has a circular cross-section 50 mm diameter. Both ends of the column are fixed. Taking factor of safety of 2. Calculate the safe load using Rankine's formula and Euler's formula. Take = 1600, f_c = 560 N/mm^2, and E = 2 × 10^5 N/mm^2.

(4 × 10 = 40 marks)